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(71) Applicant
Marconi Electronic Devices Limited

(Incorporated in United Kingdom),

Doddington Road, Lincoln LN6 0LF

(72) Inventor
Ian Arthur Davidson ·

(74) Agent and/or Address for Service
C. F. Hoste, GEC plc, Central Patent Dept. (Chelmsford Office), Marconi Research Centre, West Hanningfield Road, Gt. Baddow, Chelmsford, Essex ·

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H4K
H4P ·
H4M ·
Selected US specifications from IPC sub-classes H04J H04Q

(54) **Communications system** ·

(57) A communications system has a plurality of remote stations linked to a master station via three channels, two of which are data channels, and one of which is a signal channel. The two data channels carry time multiplexed digital signals to and from the master station respectively. The signal channel is used by all the remote stations for initiating communication with the master station, which in response to a remote station's signal allocates to that remote station a particular time slot. The system may be part of a satellite communications system, or it may be combined with a cable television distribution network.

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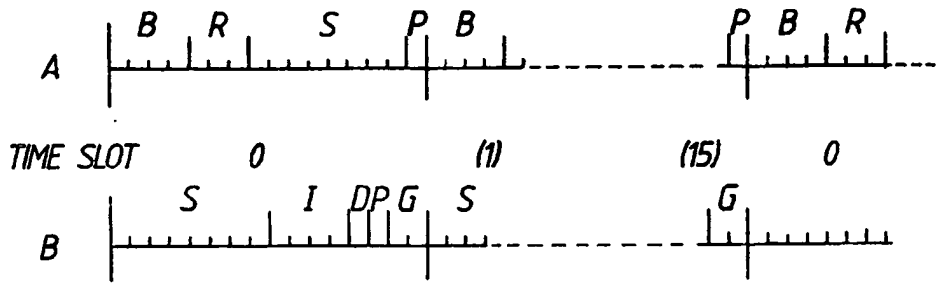
A
B R S P B
P B R
TIME SLOT
0
(1)
(15)
0
B
S I DP G S
G

FIG. 1.

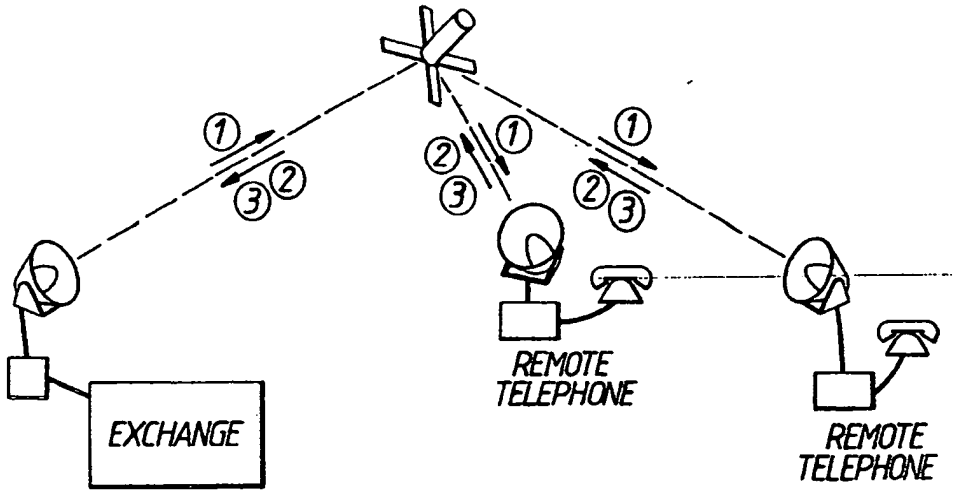
EXCHANGE
REMOTE TELEPHONE
REMOTE TELEPHONE

FIG. 2.

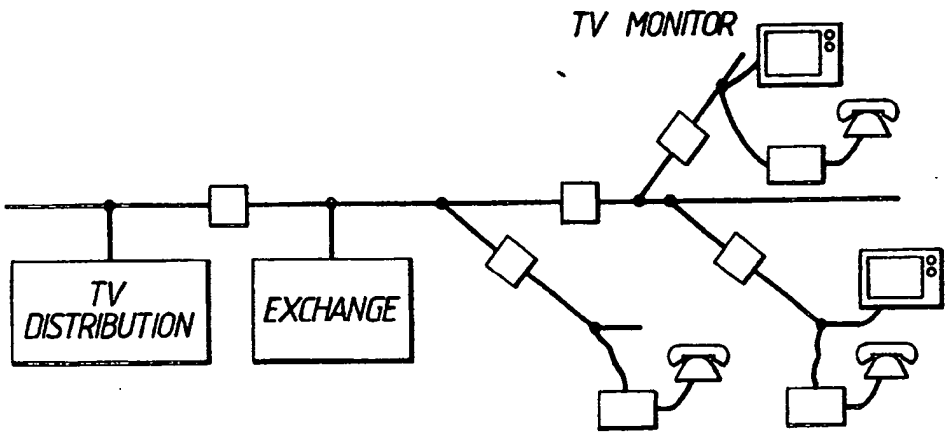
TV MONITOR
TV DISTRIBUTION
EXCHANGE

FIG. 3.

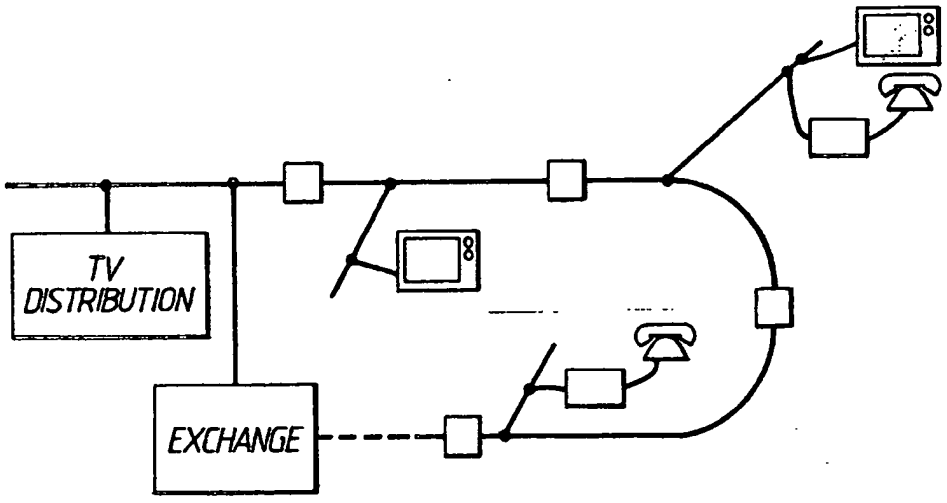
TV DISTRIBUTION
EXCHANGE

FIG. 4.

SPECIFICATION

Communications system

This invention relates to a communications system, and is particularly suitable for use with a telephone network.

According to a first aspect of this invention, a communications system includes a plurality of stations interconnected via a communications link having at least a data channel and a signal channel; means associated with a station for injecting control signals into the signal channel, which signals are utilised for the allocation of space on the data channel to permit said station to utilise said data channel.

According to a second aspect of this invention, a communications system includes a master station and a plurality of remote stations interconnected via a communications link having at least a data channel and a signal channel; means associated with a remote station wishing to utilise the data channel for injecting a control signal into the signal channel; and means associated with the master station for responding to said control signal; and for sending instructions to said remote station enabling it to access said data channel for the transmission or reception of data thereon.

Provision of the additional signal channel by means of which remote stations are given access to the communication system avoids the need for a complex overall control system or rigid hierarchy. Furthermore, it permits the communication system to be shared as necessary by additional functions, since the data communication channels can be used for the distribution of television programme material or the use of two-way transactions involving the user at a remote station in an interactive manner. The use of a signal channel having a sufficient data capacity reduces to a very low level the likelihood of cross-interference by more than one user attempting to simultaneously access the master station, thereby providing in principle a communication system having a high accessability. It is not necessary for the master station to use the signal channel in setting up a path to a remote station since the master station itself will know which are the vacant positions in the data channel. It is envisaged that portions of the data channel will include signalling information which will indicate the destination of the data carried in that channel and will alert a remote station to a message which is addressed to it. Thus, the data channel will contain normal telephone dialling and support information once the initial call has been allocated a slot in the data channel.

The communications system may utilise a satellite repeater link which serves to couple the master station with a large number of remote stations, thereby avoiding the need to lay land-lines over possibly large areas of terrain at considerable expense. The use of this communications link for such an application avoids the need for a complex master controller or the need to leave data channels vacant for each remote station in the event that it might possibly require to use it. Consequently, a more efficient use of the available data bandwidth can be made, but at the same time enabling each remote station to have immediate access to the master station.

Alternatively, the communication system may be a feature of a data distribution network of the kind used in a cable television system in which a hierarchy of cables, whether it be a tree structure or a loop system, couple together a large number of television monitors to a broadcast station. In this instance, the link to each television monitor would include facilities for handling two-way data and the terminal associated therewith may simply be a telephone or it may be a modem of some kind associated with a key-board to facilitate the transmission of two-way data. Thus the communication system would be allocated a bandwidth corresponding to that of a television channel.

The communication system is also applicable to communications within a building or room which is flooded with infra-red illumination or the like as the media for carrying the information. In this way a master station would communicate with a number of remote stations taking the form of data terminals, visual display units and/or telephones in an office environment.

The invention is further described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an explanatory diagram,

Figure 2 shows a satellite telephone system,

Figure 3 shows a cable system which incorporates a telephone network utilising a tree structure, and

Figure 4 illustrates a similar cable system organised as a closed loop.

In a practical system, it is assumed that a bandwidth of 6 MHz is available. With this bandwidth it would be possible to provide 16 telephone links having a quality sufficient for a domestic service to at least 1,000 individual telephones. The 6 MHz bandwidth would be sub-divided into the three channels, each having a bandwidth of 2 MHz. The first channel would be used for telephone traffic from the master station to the remote stations, the second channel would be used for traffic in the reverse direction from the remote stations to the master station and the third channel which is normally empty, is used by the remote stations for calling the master station in order to set up a particular call in the second channel. In this particular example the master station would be more conventionally called a telephone exchange and the remote stations would be termed subscriber's telephones.

The channel between the exchange and the telephones is conveniently broken down into 16 sub-channels, each one carrying 16 bits at a total data rate of 128 Kbits/second. Each sub-channel represents one timeslot in a time division multiplex system. The make-up of this channel is shown in Figure 1a, in which the sixteen time slots constitute a frame period. Of the 16 bits associated with each timeslot, four bits B are reserved for system signalling, three bits R are used for signalling

purposes, i.e. telephone ringing, eight bits S constitute a speech or data traffic and the remaining one bit P is used for parity purposes.

The second channel representing traffic from the telephones to the exchange consists of up to 16 blocks of data originating from 16 separate telephones but synchronised together such that they form a continuous bit stream. The make up of this channel is shown in Figure 1b, in which each handset is allocated a recurring timeslot. In each timeslot there are 14 bits (together with a guard space G, 2 bits wide) of which eight bits S represent speech or data traffic, four bits I represent time slot identification, one bit D represents signalling information (i.e. dial pulse information) and the one bit P is a parity bit. This guard space is essential to allow for small variations of the phase of the signals from individual telephones.

Referring to Figure 2 the communications system takes the form of a satellite telephone network in which a telephone exchange 1 is connected to an earth station 2 which services a satellite 3. Typically, the satellite will be in a geostationary orbit enabling it to communicate with possibly a large number of slave earth stations 4 which can be distributed over wide geographical areas. A subscribers telephone 5 is associated with each slave earth station 4. In practice, the earth stations 4 will be very small and simple, having a dish antenna of only a metre or two in diameter.

The bandwidth of the communications system is about 6 MHz, and within this bandwidth the three separate channels are located, two of these channels being as represented in Figure 1, and the third channel of 2 MHz being left vacant. When the telephone exchange wishes to contact a subscriber it utilizes the channel shown in Figure 1a, by selecting a free timeslot for that particular subscriber. When however, a subscriber wishes to initiate a new telephone call, a signal is sent in the vacant third channel to the exchange, this signal containing the identity of the subscriber and any other information which is needed by the exchange in allocating a free time slot. In practice, the procedure is automatically started when the telephone handset goes "off-hook". The telephone checks that the third call channel is free, and then sends the burst of information which gives its own identity (typically 16 bits) together with a code to indicate that it is a new call. Thus, on receipt of the signal, the exchange calls the subscriber using the channel of Figure 1a. In either case, messages from the subscriber to the exchange travel on the channel shown in Figure 1b. As the third channel is used only to permit subscribers to make initial contact with the exchange, it is generally vacant and the likelihood of interference between two subscribers is small. If, however, interference does occur, the exchange ignores the garbled signal, and waits for the subscribers to try again. Provision is made for the subscribers to try again in a staggered manner so that interference on one occasion is not followed by similar interference on the second occasion.

As only a bandwidth of 6 MHz is required, the communications system can conveniently be integrated into a cable television system in which each t.v. station requires 6 MHz to transmit its television programme material. Such a system is shown in Figure 3 in which a t.v. distributor 30 is connected via a cable to a number of geographically spaced monitors, 31, 32, via a cable organised as a tree structure. The telephone exchange 33 is connected to the cable network, and each end port of the tree network is also provided with telephones 34 in addition to a t.v. monitor. The telephone handset is provided with a station tuner in the same manner as a t.v. monitor, it merely being necessary to tune the telephone handset to that television "channel" which has been allocated to the telephone network.

Because the telephone network transmits signals in two directions along the cables, two-way amplifiers 36 are required, but these can be relatively narrow band devices, as they are required to handle a frequency spread of not more than 6 MHz.

However, to avoid even the need to include these amplifiers in the system, the combined television and telephone network can be modified to the form shown in Figure 4, in which a loop network is used. The blocks 40 represent simple unidirectional wideband amplifiers of the kind inevitably needed in a cable t.v. network of the kind which is capable of handling digital signals. Clearly, the television signals need not be returned to the exchange, and thus the broken line portion 41 indicated that only the second and third telephone channels need pass over this section.

An available bandwidth of 6 MHz permits a domestic service to be provided for at least 1000 subscriber telephones. The central exchange keeps a continuous monitor on the phase of the signal received from each subscriber's telephone, and if any phase shifts appreciably, a new synchronising signal is sent to restore correct timing. This aspect allows the system to correct for any changes in propagation characteristics, and to be used with mobile telephones which are linked by radio channels.

CLAIMS

1. A communication system including a plurality of stations interconnected via a communications link having at least a data channel and a signal channel; means associated with a station for injecting control signals into the signal channel, which signals are utilised for the allocation of space on the data channel to permit said station to utilise said data channel.

2. A communication system including a master station and a plurality of remote stations interconnected via a communications link having at least a data channel and a signal channel; means associated with a remote station wishing to utilise the data channel for injecting a control signal into the signal channel; and means associated with the master station for responding to said control signal; and for sending instructions to said remote station enabling it to access said data channel for the transmission or reception of data thereon..

3. A system as claimed in claim 2 and wherein two data channels are associated with the remote stations, a first channel of which is arranged to carry data from the master station to a remote station and the second channel of which is arranged to carry data from the remote station to the master station.

4. A system as claimed in claim 3 and wherein data traffic to and from the master station is in a digital form, and is time division multiplex under the control of the master station.

5. A system as claimed in claim 3, and wherein in response to said control system, said master station is arranged to transmit a signal to the calling remote staion via said first data channel which allocates time slots to said remote station, and which serves to synchronise the data generated by said remote station.

6. A system as claimed in claim 3, 4 or 5 and wherein the remote stations form part of a satellite communications network in which a satellite is used as a repeater between the master station and each of the remote stations.

7. A system as claimed in claim 3, 4 or 5 and wherein the remote stations are linked to the master station via cable link.

8. A system as claimed in claim 7 and wherein the cable link is shared with a television signal distribution system, and in which the bandwidth allocated to the communications system is of the order of the bandwidth occupied by a television channel.

9. A communications system substantially as illustrated in and described with reference to Figure 1 together with Figures 2, 3 or 4.

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